1991

PIPING PLOVER AND LEAST TERN MANAGEMENT PLAN

PARKER RIVER NATIONAL WILDLIFE REFUGE
NEWBURYPORT, MASSACHUSETTS

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I. INTRODUCTION

The piping plover (Charadrius melodus), a North American beach nesting bird, has been declining in numbers for decades. Although a number of factors are responsible for decreasing numbers and productivity, increased development of their ephemeral and vulnerable habitat, direct and indirect effects of human disturbance and activity, and predation are most frequently cited (Burger 1987, Haig and Oring 1987, Dyer et al 1988). Concern for the species led to the listing of the Atlantic Coast population of the piping plover as threatened in 1986.

The least tern (Sterna antillarum), another beach nesting bird, is designated as a Species of Special Concern by the Massachusetts Division of Fisheries and Wildlife. Partly due to intense management and monitoring efforts, least terns are increasing in numbers in Massachusetts, which has one of the largest populations on the Atlantic Coast.

The Parker River National Wildlife Refuge was established in 1942 and is managed, as part of the National Wildlife Refuge System, for the protection of wildlife and wildlife habitat. The 4662 acre refuge includes the southern two-thirds of Plum Island, six miles of undeveloped barrier beach habitat. The area supports a wide variety of wildlife including 270 species of birds and is a mecca for birders. The area is a popular tourist attraction and the refuge receives an estimated 400,000 visits annually for birdwatching, beach use, surf fishing, environmental education, photography, waterfowl and deer hunting, and other activities.

With the development and alteration of beaches along the Atlantic Coast, the preservation and management of the undeveloped beach habitat at Parker River for the piping plover and least tern became increasingly important. With habitat available, it became apparent here that the important limiting factors were impacts from recreational activities (over-sand vehicles, pedestrians and pets), and predation. It is recognized that use of OSV's (over-sand vehicles) are incompatible with plover and tern nesting. Given the plover behaviors (getting caught in tire tracks and being unable to get out, hunkering down in tracks in response to oncoming OSV, attempting to flee oncoming OSV by moving ahead in a tire track) and the cryptic plumage of the chicks, the direct threat from OSV's would appear obvious. Scott Melvin of the Massachusetts Division of Fisheries & Wildlife has compiled a list of incidents where chicks were run over by OSVs. Flemming (1988) found that high vehicular activity led to prolonged pedestrian activity and associated problems.

Impacts from pedestrian beach use include nests being abandoned, destroyed, and increased energy costs to the birds in moving away from the disturbance. Cairns (1977), studying piping plovers in Nova Scotia, found that the beaches with lower plover nesting success had more recreational use and that this human disturbance may "prolong incubation and fledging periods by reducing the proportion of time spent in incubation and feeding, thereby increasing the risk of failure". Goldin (1988), studying plovers at Breezy Point, New York, reported that human disturbance may be affecting plover productivity by less tangible means. Laskowski (1987a), studying plovers in New Jersey, found that various human activities affect plover feeding rates. Both Goldin (1988) and Laskowski (1987b) observed that recreation by humans was concentrated at the intertidal zone, a critical feeding habitat for the plover. Plovers, as other species, have an energy threshold. Griffin et al (1989), studying plovers in Rhode Island, noted that if this threshold is exceeded for certain period due to human disturbance, plovers may be more susceptible to other mortality factors.

Flemming et al (1988) believed that a decline in plover numbers in Nova Scotia was due to human disturbance that was altering chick behavior. A number of areas have reported increased productivity after an area is closed off from the public (A. Hecht, pers. comm.)

Parker River NWR, along with many other sites, report that nest and chick predation is also an important limiting factor. This increase in predation has also been associated with human activities (Strauss et al. 1990, Burger 1987). The species of predator and the extent of predation varies between sites. Rimmer and Deblinger (1990) reported that predation has clearly limited success at Crane's Beach in Massachusetts. Nest predation by red fox, crow, striped skunk and herring gull destroyed 71% of unprotected plover nests. During a study of piping plovers on outer Cape Cod, Massachusetts, MacIvor et al (1990) found that predators (mainly red fox) destroyed 52-81% of all active nests at one site. Predation has been a problem at Parker River NWR as well. Predation resulted in a loss of 96 least tern nests and one piping plover nest in 1990.

Censusing and management efforts including public education, beach zonation, spot fencing, and predator control have increased at many locations and are frequently coordinated through State authorities.

Parker River management, monitoring activities and nesting success are described in the refuge Annual Narratives, the refuge 1988 Plover Action Plan, by Secatore (1986) and Hereford (1990), and is shown in Table 1. An effective comparison of nesting success between years is not possible since different terms are used for description. Protective fencing for least terns was first used in 1962 when 100 pair attempted nesting. Since that year, up to 80

nesting pair have been recorded on the refuge beach. Production has varied considerably, from 0 to 74 young.

Management for and record keeping of piping plovers did not begin until nearly 20 years later (Table 1). The first recent records of the plover listed two pair attempting to nest in 1980. Since then, two to five nests were recorded on the refuge beach until 1990. Management for the plover began in 1986, the year of listing, when protective or symbolic fencing was first used to protect plover nests. Seasonal zonation also began in 1986 when nearly half the beach (3 miles) was closed. That same year volunteer plover wardens were enlisted. In 1988, predator exclosures, predator trapping and frequent beach censuses were instituted. Very few of the nesting attempts had been successful. Only zero to four young have been produced yearly. Five to nine young were recorded in 1984, but no age was given. In 1990, there was a dramatic increase in plover success as up to 22 adults were seen on censuses, and ten pairs nested and produce 14 fledged young. It appears that the combination of management techniques employed at Parker River NWR along with enhanced habitat and benefits from successes here and elsewhere led to a successful 1990 season.

This Plan discusses efforts by Parker River NWR for managing piping plovers and least terns for the 1991 season.

II. JUSTIFICATION AND CONFORMANCE WITH STATUTORY AUTHORITY

A. The Fish & Wildlife Service Refuge Manual (7 RM 2.1) identifies "protection, enhancement, and recovery of endangered and/or threatened species will receive priority consideration in the establishment of refuge objectives and the management of national wildlife refuges." Species listed by the State as endangered or threatened will also be given consideration. Objectives of endangered species management (7 RM 2.2) are to prevent extinction, restore listed species to non-endangered status, protect ecosystems, and to "ensure that conflicts between endangered species and other wildlife management or public use programs are resolved in favor of endangered species."

B. The Endangered Species Act of 1973 authorizes the Fish & Wildlife Service's endangered species program. Section 7 of the Act requires all Federal agencies to ensure that actions authorized, funded, or carried out by them are not likely to jeopardize listed species or result in destruction or adverse modification of the critical habitat. Agencies are required to consult with the FWS under this Section 7. Therefore, refuge managers are to perform intra-FWS consultation before initiating projects which affect or may affect endangered species.

Section 7 consultation was completed by Regional Endangered Species and refuge staff on January 24, 1991 resulting in the decision to close the entire refuge beach beginning April 1, 1991. This decision is based on the expansion of plover activity in 1990 and the anticipated continuation of this level of activity in 1991. The decision concludes that leaving areas of potential plover habitat open to public use, access, and recreation adversely affects a listed species (piping plover).

C. The Parker River NWR Master Plan (1986) lists as a refuge objective the protection and enhancement of breeding and maintenance habitat for non-game birds, especially those with decreasing populations and identifies specific long range production goals.

D. Atlantic Coast Piping Plover Recovery Plan (Dyer et al, 1988) lists goals and management needs and objectives. In that document, Parker River NWR was identified as suitable plover habitat where intensive management was needed to control limiting factors.

E. The "Refuge Recreation Act of 1962" and the "National Wildlife Refuge System Administration Act of 1966" both refer to compatibility requirements governing recreation on refuges in relation to wildlife. Both Acts are reflected in Service policy requiring a compatibility review of all recreational activities that may adversely impact wildlife, especially endangered or threatened species. Research data indicates that human intrusion into plover habitat during pair bonding, establishment of nesting territories, and during nesting has an adverse effect on the success of plover production. A compatibility review warrants total closure of the refuge beach to provide undisturbed habitat for the anticipated expanded use by piping plover in 1991.

III. OBJECTIVES

A. According to the Atlantic Coast Piping Plover Recovery Plan (Dyer et al, 1988), recovery objectives include increasing the Atlantic Coast population to a self-sustaining population of 1200 breeding pairs while maintaining the current distribution pattern.

Parker River NWR objectives are to maximize production of the piping plover (with mean productivity of 2.0 chicks fledged per nesting pair) and least tern on refuge lands by reducing predation and human disturbance.

B. To educate the public about the plight of the piping plover and least tern and efforts by the refuge to restore them.

IV. MANAGEMENT AND MONITORING ACTIVITIES

A. Seasonal Zonation--Beach Closure

Effective April 1, the entire refuge beach and dunes area will be closed to all public use (Figure 1). This closure will extend from the northernmost boundary (vicinity of Lot #1) southward to the common boundary between the refuge and the Sandy Point State Reservation. There will be no beach access permitted from parking lots #1, #2, #3, #5, #6, and #7. Parking lots will be fenced off and closed.

Expansion of plover activity in 1990 during early June prompted extension of the beach closure northward to the vicinity of parking Lot #1, a total of 5 1/4 miles. The expanded closure resulted in a decrease in available space for public recreation resulting in public confusion and many disappointed visitors. To preclude repeat of the situation, the total closure will be implemented with increased public notification to advise the public of refuge accessibility.

Parking Lot #4, Hellcat Swamp Nature Trail, two observation towers, and the Salt Pans Area will remain open for wildlife observation. The refuge road will also remain open, with access to the Sandy Point State Reservation continuing as in the past.

The Lot #7 parking area will allow for 5 spaces to accommodate visitors wishing to use the Stage Island Pool Observation Tower for birdwatching.

This closure also applies to refuge personnel, except for travel on the beach for censusing and monitoring including predator exclosure construction and disbanding as described below. Monitoring will be done on foot whenever possible. Law Enforcement staff will not routinely drive through the closure but may have to occasionally enter the closed area to deal with trespassers and respond to emergencies. Minimizing disturbance will be a top priority, secondary only to the safety of visitors and staff.

Red plastic fluorescent snow fencing will be erected at the north and south boundary, from the mean high water mark extending west to the beginning of the dune. A large "Area Closed" sign will be posted on the fencing at each boundary. This sign identifies the area as a nesting area for endangered species. Smaller signs indicating "Restricted Area-This is a natural breeding ground for terns and plovers" will be posted on stakes at the north and south boundary.

The closure will remain in effect until August 31, or until fledging of young plover has occurred allowing sufficient time for young birds to sustain flight. A chick will be considered fledged when it has been observed to fly 50 feet or more, at approximately

20-25 days of age. A period of ten days from fledging will be allowed to permit young birds to feed undisturbed and gain strength in preparation for migration.

Based on the lack of actual observed piping plover activity, sections of the beach may be reopened to public use, access, and recreation, if such an opening is deemed compatible with remaining closed areas, and is biologically safe to do so (to be defined as that point in time beyond which initiation of nesting activity would most probably not be successful in producing chicks capable of southward migration). If nesting (laying of the 1st egg) does not occur in an area of the refuge beach by July 1, 1991 - then that area may be considered for reopening.

Public use, access, and recreation programs will be accommodated as follows:

Beach Use: Access for general beach use will be postponed, pending establishment of nest sites by piping plover. Reopening of unused areas of habitat directly accessible by boardwalks will be considered as early as biologically sound (based on absence of plover activity).

School Groups: Bona fide educational institutions and schools scheduled to visit the refuge for educational purposes will be allowed access to the Hellcat Swamp Nature Trail throughout the beach closure period. Access to "Emerson's Rocks" (vicinity of lots #6 and #7) or the refuge beach may be accommodated only if no piping plover activity is observed or recorded. If such nesting activity has occurred, access will be postponed or re-directed to the Hellcat Swamp Nature Trail.

In addition, the refuge will offer programs at schools interested in the Fish and Wildlife Service efforts to protect and enhance the status of the threatened piping plover. These programs (at the school) will be offered in lieu of trips to the refuge.

Recreational purpose/school groups wishing to visit merely for a day at the beach will be directed to other areas in the vicinity.

Surf-fishing: The surf-fishing program will be suspended during the beach closure period or until such time as access/areas can be safely re-opened to accommodate this access and use. If specific beach access/boardwalk areas do not receive plover use as indicated previously - such areas can be re-opened; allowing sufficient buffer distance (north and south of the boardwalk) to the nearest nest. Areas so opened will be available to walk-on fishermen. Over-the-sand vehicular surf-fishing access may be permitted as above, if plover activity is non-existent in areas in close proximity to vehicular access routes, again allowing for sufficient buffer distance to the nearest nest.

Shellfishing: Access to designated refuge shellfishing parking/access points will be allowed via refuge shellfishing permits throughout the beach closure period. Use of a refuge shellfishing permit to access other than clam flats will result in revocation of the permit.

Beached fishing gear/lobster pots will be retrieved only by refuge personnel during the time period (and area) of the beach closure. Gear will be stored at the refuge Visitor Contact Station (Lot #1) for pickup by identified owners.

From 1986 to 1990, a partial closure of the beach was instituted. The location of the closure was selected to reflect the plover activity the previous year. In 1990, the area from one mile north of Camp Sea Haven south to parking lot 6 was closed beginning April 1. That area was closed in 1990 because plover activity and nesting was centered there in 1989. Early plover activity (an average of 75% of sightings on the censuses) in 1990 was centered in this closed area. However, at least three pairs defended territories and two pairs eventually nested in the northern section of the beach. The closure was expanded northward to 0.3 miles south of parking lot #1 in June to protect the nests before they were due to hatch. In summary, there was plover and tern activity and nesting in the northern, middle, and southern parts of the beach in 1990.

In 1990, most of the early plover activity was centered in the southern area of the refuge beach, which was closed to public use for the plovers and terns, indicating a possible preference for protected areas. With the recent plover fledging success at Parker River and nearby Crane's Beach and the tendency of plovers to return to a successful area, it is expected that at least as many adults will be observed on the censuses in 1991, given good habitat conditions. It will be important that protection begin early in the season. This would ensure fewer nest failures due to recreational disturbance. It would also result in earlier hatching which in turn may allow for an earlier lifting of the closure.

B. Law Enforcement

Enforcement of the closure will continue to be given high priority by refuge management and Law Enforcement staff. There will be at least four full-time refuge officers on staff during the nesting season so that at least one officer will be on duty during daylight hours during the week and two during weekends and on holidays. There will be no vehicle patrol inside the closure unless pursuing trespassers, and that vehicle travel must be no faster than 5 mph. Surveillance of the closure will be done from the boundaries, and radio communication with plover wardens and biological staff.

C. Predator Control

Predators that have or are likely to prey on plover/tern nests and/or young will be removed according to procedures described in the refuge's Animal Control Management Plan. The refuge has possessed a valid State permit for the taking of red fox, striped skunk, raccoon, and opossum. A permit for the 1991 season will be obtained in January 1991.

Animal control efforts will be focused on removing predators just before the nesting season. Tracks from two or more predator species were observed at or near all nesting areas in 1990. All refuge least tern colonies were depredated and nest loss due to predation was over 70%. Most of the plover nests were in the vicinity of tern colonies. Fledging success of the piping plovers was lower in certain areas of the refuge than others and it may be reasonable to assume that a cause of this chick disappearance is predation, since there were more predator tracks in those areas. Box-type live traps to capture the animals will be set out in early March and monitored each day at first light through April. Trapping may continue at specific sites in response to problem animals in nesting areas. Target animals caught in traps and/or found after hours by LE personnel in nesting areas will be humanely euthanized. Records will be kept on date, location, and species and number of animals removed.

Predator removal is very labor intensive. Leg hold traps are unlawful in Massachusetts and box traps are relatively ineffective for red foxes. Intensive removal will not be undertaken at the expense of: (1) effective use of predator exclosures and (2) intensive monitoring of nests and chicks.

The use of predator exclosures, under authority of a State permit, has been very effective at Parker River NWR in reducing nest predation. There was no predation on plover nests protected by exclosures in 1990. Due to the level of predator activity found at all sites in the past, predator exclosures will be placed around all plover nests in 1991. The technique and materials as described by Rimmer and Deblinger (1990) will be used again in 1991.

When possible, exclosures will be erected after the clutch has been completed to reduce chances of disturbance. Eighty percent of the exclosures on refuge lands in 1990 were erected after four eggs. However, due to high local predator activity, one exclosure was installed after one egg and another after two eggs with no pair desertion. If there is reason to believe that predation pressure in the area of a nest is severe in 1991, an exclosure will be erected around the nest before clutch completion. Because the risk of abandonment may be higher than after clutch completion, these exclosures will be constructed quickly and carefully. Exclosures will be disassembled and removed as soon as possible after hatching.

A State permit for exclosure use in 1991 will be obtained and all State reporting obligations will be met. Information such as time of construction, number of visits needed, how long until the adults returned to the nest, etc. will be recorded.

In 1991, an attempt will be made to also erect a fence exclosure around one or two least tern colonies depending on the size of the colony. The twine top covering will not be added, as on plover exclosures. Others (D. Rimmer, pers. comm.) have used exclosures and increased tern productivity substantially. A comparison will then be made with unprotected colonies.

D. Monitoring

The censusing of plover/tern numbers and monitoring of nesting via beach surveys will commence the first week in April. The surveys will be done three times weekly in April during arrival and territory establishment by plovers. The frequency will increase to four to six times weekly in May for observation of pair bonding and nest initiation, and continue into August with incubation, hatching and fledging. Each nest and brood will be monitored four to six times weekly. The survey frequency will decrease to two to three times weekly after the young fledge and up to the time the birds leave the refuge.

In an attempt to more accurately describe location on the beach, markers will be placed in the sand beginning at the north beach boundary and every 0.1 miles to the south beach boundary. The markers will be inscribed or painted (0.1, 0.2, 0.3 etc.) and be placed at the foredune boundary.

Refuge personnel will conduct the surveys. One to two people (Biologist and/or Biotech, for example) will slowly drive the length of the refuge beach. Accurate records will be kept on a Daily Survey Sheet (Attachment #1), beginning with time, weather and tide conditions. Once birds are spotted, information on behavior will be recorded. Location will be plotted on a map.

Vehicles are very ineffective for finding nests. Nest searches will be made by walking transects through beach and dune areas, observing behavior of the birds on a territory, and following piping plover tracks in sand to the nest. Vehicles can be used to pick up and drop off searchers. A walking check for nests will be done two to three times weekly.

Sex of adults will be determined by breast and head plumage, bill color, and behavior. To differentiate individuals, drawings of bill patterns, and plumage will be made. Each nest and colony will be assigned a name, and pertinent information from the Daily Survey Sheet will be recorded onto the appropriate Nest Record Sheet

(Attachment #2) to track the progress of each nest attempt. Incomplete nests will be checked daily to determine date of last egg. Predator exclosures will be erected after clutch completion (see IV. C.). To determine hatching date, the average 27 day incubation period is added to the date of the last egg.

Vehicles are efficient for monitoring nests once they have been found. After clutch completion, to minimize disturbance of adults and the potential for attracting predators, nests will be checked with binoculars from a distance. Careful observations of nests will also be made around the expected hatching date to determine number of chicks hatched and hatchability. Careful searches of unsuccessful nest sites will be made to determine cause. Unhatched eggs will be opened to determine fertility and embryo viability.

Young chicks will be monitored closely to record behavior, location, and fledging. A chick will be considered fledged when it has been observed to fly 50 feet. Since the fledging success of piping plovers at Camp Sea Haven area was much reduced compared to the broods at the northern or southern refuge beach, an attempt will be made to do some longer term focal behavioral observations of broods hatched near Sea Haven.

E. Public Information

Produce 3-4 news releases about the closure, nesting, success of season and reopening of beach.

Give informational handouts on plovers and terns along with map of closure to visitors as they enter refuge.

Provide plover/tern information in kiosk.

Recruit refuge volunteers to work as Plover Wardens for the north and south boundaries of the closure. Plover wardens will intercept and interact with the visiting public on the beach and provide info on plight of plovers/terns and the closure. They will wear FWS volunteer caps and be equipped with portable radios to contact LE officers in case of closure violations.

F. Coordination

Cooperation between refuge personnel with U.S. Fish & Wildlife Service (FWS) division and regional personnel, Crane's Beach (Trustees of Reservations), State Environmental Protection Officers, Sandy Point State Reservation Manager(s), and the State Division of Fisheries and Wildlife (DFW) will continue.

Brief updates will be done regularly during the nesting season and sent to:

Gerry Atwell, Division Biologist, FWS
Scott Melvin, Endangered Species Biologist, Mass. DFW
Brad Blodget, State Ornithologist, Mass. DFW

Periodic updates on management practices will be sent to local selectmen and Federal and State legislators.

Refuge personnel will participate in the State piping plover and tern census and the 1991 International Piping Plover Census.

A report on activities conducted under the State predator removal and exclosure use permits will be completed and submitted to Mass. DFW.

Refuge personnel will attend the State post-season plover/tern reporting meeting in August.

An annual report on the 1991 plover and tern season will be completed and distributed to cooperators (shown above) and made available to others.

V. TIMETABLE

January
Procure State permit for predator removal from Mass. DFW
Hire Biotech

February
Procure materials for trapping
Obtain State permit for predator exclosure use

March
Biotech begins work
Install beach markers
Begin predator removal
Recruitment of plover wardens
Orientation of plover wardens
News release on closure, and radio spots
Procure materials for predator exclosures

April
Put up north & south boundary closures (4/01)
Put up plover signs (4-01)
Close of parking lots (4-01)
Plover wardens begin work
Begin beach surveys
Continue predator removal

May
Beach surveys, begin exclosures as needed
Participate in State and International census of plovers

June
Continue beach surveys
Continue exclosure construction and disassembling as necessary
Participate in State Tern census
News release on nesting

July
Continue beach surveys
Continue exclosure disassembling and removal

August
Beach surveys end
Attend State plover/tern reporting meeting
News release on re-opening of beach and fledging success
Complete and submit predator exclosure report
Remove north and south boundary closures
Remove plover signs
Open parking lots

September
Complete and distribute annual report on activities and nesting success

October-December
Complete and submit results of activities under State trapping permit

Prepare 1992 Annual Management Plan

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Table 1. Management for and production of least terns and piping plovers at Parker River NWR

Year	Management	Tern Production	Plover Production
1962	protective fencing*	100 pr., ?Y	?
1965-1972	none	reference to attempts, no data	
1974	none	30 Y	?
1975	fencing	10 Y	?
1976	signs, fencing	?, washout	?
1977	?	no colony establ.	?
1978	section of beach fenced off and closed to public use after terns showed interest*	20 pr., ? Y	?
1979	1 mile of high beach fenced off, 1 parking lot (2 Or 3) closed.	15 nests, ? Y	?
1980	In May, 1 mi. of high beach closed from lot#1 south. Half of lot#1 closed to parking.	3 colonies 38 Y 2 killed by OSV	2 pr., both abandon due human, skunk
1981	Half of lot#1 and all of lot#2 and BB1 closed.	80 pr., 70 Y	5 nests, ?Y heavy pred.
1982	protective fencing for terns	10-15 pr. 10 Y	?
1983	protective fencing for terns	25 pr., 25 Y	1 pr., 2Y
1984	protective fencing for terns	56 Y 12 fledged	2-3 pr. 5-9 Y
1985	prot. fencing for plovers*	50 pr., 0 Y	1 nest,2 Y
1986	half of beach closed* tern wardens*	?	3 nest.pr. ? 2Y
1987	half of beach closed prot. fencing for terns tern wardens	24 nests, O Y	1 nest,O Y

Table 1. Continued

1988	half beach closed tern wardens predator exclosures* predator trapping* frequent beach surveys*	2 colonies 6-16 pairs. 0 Y	1 pr., 0Y
1989	Southern beach closed prot. fencing for terns tern wardens predator exclosures predator trapping	88 nests 74 fledged	2 nests 4 fledged
1990	Southern beach closed; additional closure for total of 5.25 miles Predator trapping; census; Predator exclosures; Symbolic fencing.	80 nesting pr. 12 fledged	10 nest. pr. 14 fledged 22 adults- high census count

*=first year for that management technique
Y=young
?=unknown, no data available

ATTACHMENT #1

Parker River NWR
Biology
1991 Plover Survey Form

Date: Time Begin: Time Finish:
Observer(s):
Weather-- Temp.: Cloud Cover: Precip:
Tide Status: Wind:

I Number: Time: Location:
Markings:
Behavioral Observations:

Nest data:

II Number: Time: Location:
Markings:
Behavioral Observations:

Nest data:

III Number: Time: Location:
Markings:
Behavioral Observations:

Nest Data:

IV Number: Time: Location:
Markings:
Behavioral Observations:

Nest Data:

V Number: Time: Location:
Markings:
Behavioral Observations:

Nest Data:

Other Observations/Comments:

Reminder: Clean vehicle
Leave vehicle with at least half-tank gas

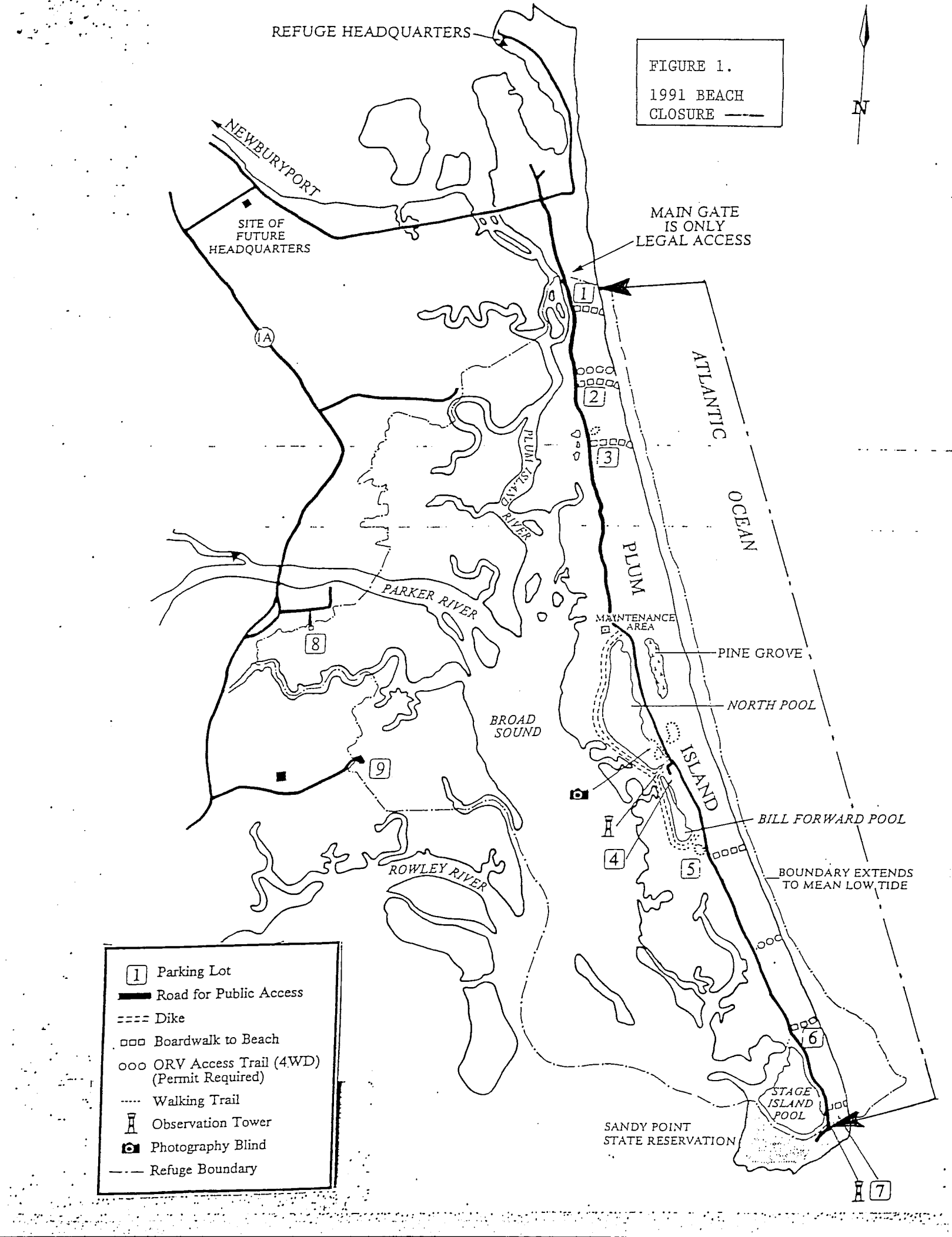
ATTACHMENT #2

PKR BIOLOGY
1991
PIPING PLOVER NEST RECORD

Nest Name: _____
Location: _____
Nest Habitat: _____
Description of Adults: _____
_____
Date/Time Nest Found: _____ Number of Eggs: _____
First Attempt/Renest: _____
Date Exclosure Erected: _____ Number of Eggs: _____
Subsequent Egg Dates--2nd Egg _____ 3rd Egg _____ 4th Egg _____
Estimated Hatch Date: _____
Date Hatched: _____ Number of Eggs Hatched: _____
Date Nest Failure: _____ Cause: _____
Estimated Fledge Date (+25 days): _____

Nest Checks

Date	Time	Tide	#Eggs	#Young	Adult	Comments


REFUGE HEADQUARTERS
FIGURE 1.
1991 BEACH CLOSURE
N
NEWBURYPORT
SITE OF FUTURE HEADQUARTERS
MAIN GATE IS ONLY LEGAL ACCESS
1A
ATLANTIC OCEAN
PLUM ISLAND RIVER
PLUM ISLAND
PARKER RIVER
MAINTENANCE AREA
PINE GROVE
NORTH POOL
BROAD SOUND
BILL FORWARD POOL
ROWLEY RIVER
BOUNDARY EXTENDS TO MEAN LOW TIDE
STAGE ISLAND POOL
SANDY POINT STATE RESERVATION
1 Parking Lot
Road for Public Access
Dike
Boardwalk to Beach
ORV Access Trail (4WD) (Permit Required)
Walking Trail
Observation Tower
Photography Blind
Refuge Boundary